Guidelines to Local Government Bodies on Pollution Control for Low Polluting Industries and for Issuing of Environmental Protection Licences

Central Environmental Authority

Environmental Protection Division

Ministry of Environment and Parliamentary Affairs

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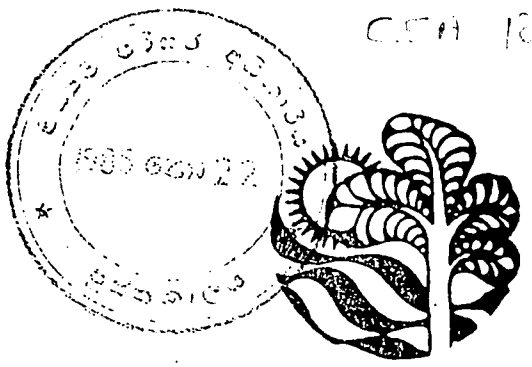

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INDUSTRIAL POLLUTION IN THE KELANI RIVER

PRELIMINARY SURVEY AND INTERIM REPORT

VOLUME I

CENTRAL ENVIRONMENTAL AUTHORITY OF SRI LANKA

1985

VOLUME I

C O N T E N T S

VOLUME II

C O N T E N T S

VOLUME II

C O N T E N T S

*CISIR REPORTS :

SUMMARY

In October, 1982, as directed by the Development Secretaries Committee, after a major fish kill in the Kelani River, the Central Environmental Authority made a preliminary study of industrial discharges into the river, in order to assess areas where problems could arise, and recommend methods of effluent treatment.

Consequently, the Ceylon Institute of Scientific and Industrial Research (CISIR) was commissioned to study and report on major industrial units whose effluents finally entered the river. In the present report these investigations on 21 factories are reviewed, summarised, and recommendations made by the Central Environmental Authority.

Conclusions and Recommendations :

1. Toxic Materials :

All stable, toxic materials in effluents being discharged into the river, must be removed at the source (ref. CEA Interim Standards).

2. Maintenance of effluent quality

In each factory, safeguards to check and monitor effluent quality before discharge should be effectively maintained

There is circumstantial evidence that negligence at the State Fertilizer Manufacturing Corporation, leading to the discharge of excessive free Ammonia in the effluet, has been responsible for more than one fish kill.

3. A. Above Ambatale

River water upstream of Ambatale should be of high quality as the water is used for human consumption. Effluents discharged in this part of the catchment need complete treatment.

B. Below Ambatale

Values for certain parameters could be relaxed for effluents discharged in areas down-stream of Ambatale.

4. Monitoring of River Water Quality :

Regular monitoring of the river should be continued to assess changes in quality at points of industrial discharge.

5. Possible Groundwater Pollution :

Industrial effluents being discharged into low lying areas in the vicinity of the river leads to groundwater contamination. This needs further study.

6. Pollution of Colombo Canals :

Industrial enterprises on the Colombo North Canal System constitute a major pollution source. It is recommended that these studies be expanded to formulate an action plan for rehabilitation of the canal system.

7. Legal :

It is recommended that adequate legislation be enacted to provide for the effective enforcement of environmental standards.

9. Central Treatment Plants :

Assistance should be obtained to install and operate central treatment facilities which could be made use of as common treatment plants by other industries in the vicinity (on a cost sharing basis).

A specific recommendation is common treatment of tannery effluent and the removing of chromium by a central plant at the Leather Products Corporation in Mattakkuliya.

INTRODUCTION

1.1 In October 1982, following on a fish kill in the Kelani River, it was decided that studies be made on the following, on the directions of the Development Secretaries Committee :

a. Water quality in the Kelani River be continuously monitored, especially at the discharge points of industrial plants :
b. An immediate survey of the Industrial Plants along the Kelani River be undertaken to ascertain discharge of treated or untreated industrial effluents into the River :
c. Recommend methods of effluent treatment and/or process modification in order to abate pollution of the river and prevent any recurrence of fish kills.

1.2 In this connection, the National Water Supply and Drainage Board was requested to monitor continuously water quality as per (a) above and report to the Government through the Central Environmental Authority.

The Ceylon Institute of Scientific and Industrial Research (CISIR) was entrusted to undertake (b) and (c) above and report to the Government through the Central Environmental Authority. The NWS & DB and CISIR were delegated powers under Section 26 of the National Environmental Act No. 47 of 1980 for this purpose.

1.3 In response to this, the CISIR, commencing in September, 1983, identified and conducted investigations on major industries whose effluents finally enter the river. Twenty one (21) of these have now been completed.

These were :

1. Leather Products Corporation Tannery, Mattakkuliya
2. Madampitiya Sewage Works
3. Ambatale Water Treatment Plant
4. Plywood Corporation Wood-work Complex, Kosgama
5. Kalatuwawa Waterworks
6. Labugama Waterworks
7. Petroleum Refinery
8. State Fertilizer Manufacturing Corporation
9. MacCallum Brewery
10. Ocean Foods and Trades
11. Pugoda Textile Mills
12. Steel Corporation, Oruwela
13. British Ceylon Corporation Ltd.*
14. Petroleum Storage Complex, Kolonnawa*
15. Lever Brothers (Cey.) Ltd.*
16. Kelani Tissa Power Station
17. Ceylon Cold Stores Bottling Plant, Kaduwala
18. Ceylon Tyre Corporation
19. Lankem (Cey.) Ltd.*
20. Synthetic Textile Mills Ltd.*
21. CTB Depot, Peliyagoda.

1.4 The CISIR prepared preliminary study reports on each of the industrial enterprises listed above, determining the nature and volume of effluent being discharged into

* Industrial enterprises situated on the banks of the Colombo North Canal System

the Kelani River, focussing attention on areas where problems could arise and identifying areas for a detailed examination. (These reports are attached as Annex VII)

1.5 The CISIR reports were examined and a summary of the findings and recommendations was prepared by the Central Environmental Authority including the principle which must be applied in effluent treatment by each major industrial unit.

1.6 A meeting convened in May 1984, comprising representatives of the following agencies and organisations, considered the uses of the Kelani water, and recommended policy guidelines regarding pollution control :

* Urban Development Authority
* Ceylon Institute of Scientific & Industrial Research
* National Aquatic Resources Agency
* Coast Conservation Department
* Greater Colombo Economic Commission
* Colombo Municipality
* National Water Supply and Drainage Board
* Central Environmental Authority

1.7 In addition, the National Aquatic Resources Agency (NARA) is presently engaged in a comprehensive water quality monitoring programme of the lower reaches of the river.

CONCLUSIONS

2.1 All stable,toxic materials in effluents being discharged into the river must be removed at source :

Critical parameters affecting aquatic life are as follows:

i. Chromium with particular reference to effluents from Leather Products Corporation Tannery and other tanneries

ii. Ammonia with particular reference to effluents from the urea plant (SFMC)

iii. Oil with particular reference to effluents from :

Petroleum Refinery
State Fertilizer Manufacturing Corporation
British Ceylon Corporation Limited
Petroleum Storage Complex
Garages

iv. Dyes, Acids, Alkalis with particular reference to effluents from Textile Mills.

A. Chromium

CISIR report on the Leather Products Corporation Tannery points out excessively high values for chromium in the effluent (417.5 mg/l, std. limits 1.0 mg/l). Chromium has also been detected in the bottom sediment and vegetation in the lower Kelani. It is also known to concentrate in many aquatic shell-fish and other organisms. The direct influences of chromium (hexavalent) on human health, when ingested in large quantities are : Vomiting, Stomach-aches,Decrease in Urine, Convulsions and Coma.

B. Ammonia

CISIR have reported the free Ammonia content in Urea Factory effluent basin to be far in excess of allowable limits. It is probable that the chief offending parameter with respect to the recorded fish kills in the river is free Ammonia. A recent survey conducted by NARA have revealed inordinately high values for free Ammonia in close proximity to the Urea Factory, on a date when there was a minor fish kill (21-09-1984). Water containing 1 mg/l of free Ammonia can cause suffocation of fish, and the allowable limit is 1.2 mg/l. (Annex V)

Central Environmental Authority has recommended:

a. dilution of Ammonia in the effluent basin to the accepted limit at all times ;
b. redesign of basin to ensure adequate mixing with dilution water and
c. sludge from the water treatment plant not to enter effluent basin but be handled separately.

C. Oil

Oils and grease discharged into inland surface waters can cause the following effects on aquatic organisms ;

a. Heavy oil tends to stick to bodies of fishes and suffocate gills ;
b. Larvae are seriously damaged by oil deposition ;

c. Fish cannot be used for food because of the smell of heavy oil.

D. Textile Effluents

Excess dye stuffs in the effluent can have toxic effects (including cancer) on aquatic organisms. Some dyes may accumulate in the organs of fish and colour their flesh. Dye effluents can also contain toxic heavy metals. Acids and alkalies also cause fish kills (as at Embilipitiya).

2.2 Taking into consideration, the uses of Kelani water at different points ;

2.2.1 The river water upstream of Ambatale, as well as areas which will affect Ambatale due to tidal effects should be of high quality, as the river water is used for human consumption. Effluents in this area need complete treatment, (Annex I.) so that the river water meets the standards specified for raw water to be used for a potable water supply after treatment.

2.2.2 Values for certain parameters e.g. BOD could be relaxed for effluents discharged in areas downstream of Ambatale .

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A large part of the BOD in the river is derived from sewage and garbage.

Adequate rural sanitation programmes in the catchment should be formulated.

a. It is noted that two k.m. inland from the shore line comes under the purview of the Coast Conservation Act. Also the values for the parameters for waste waters discharged into marine coastal waters are not as strict as those for discharge into surface waters (Annex III).

b. With the city sewage discharge shifting from Madampitiya to the Northern Ocean Outfall there should be corresponding improvement in water quality at the mouth of the Kelani. (CEA recommendations and proposals on this project, with particular reference to removal of suspended solids and floatables before final discharge appear as Annex VI)

c. There appears to be no major projects for the river mouth and estuary, since no data have been filed with the Central Environmental Authority or the Coast Conservation Department.

2.3 Regular monitoring of water quality of the river should be carried out :

a. Very little data on water quality is presently available to serve as a base for assessing changes in water quality.

Changes in quality at points of industrial discharges can then be assessed.

b. Monitoring should also include bioassays, and assays of aquatic organisms which would reveal toxic effects as well as bio-concentration of harmful chemicals in particular organisms.

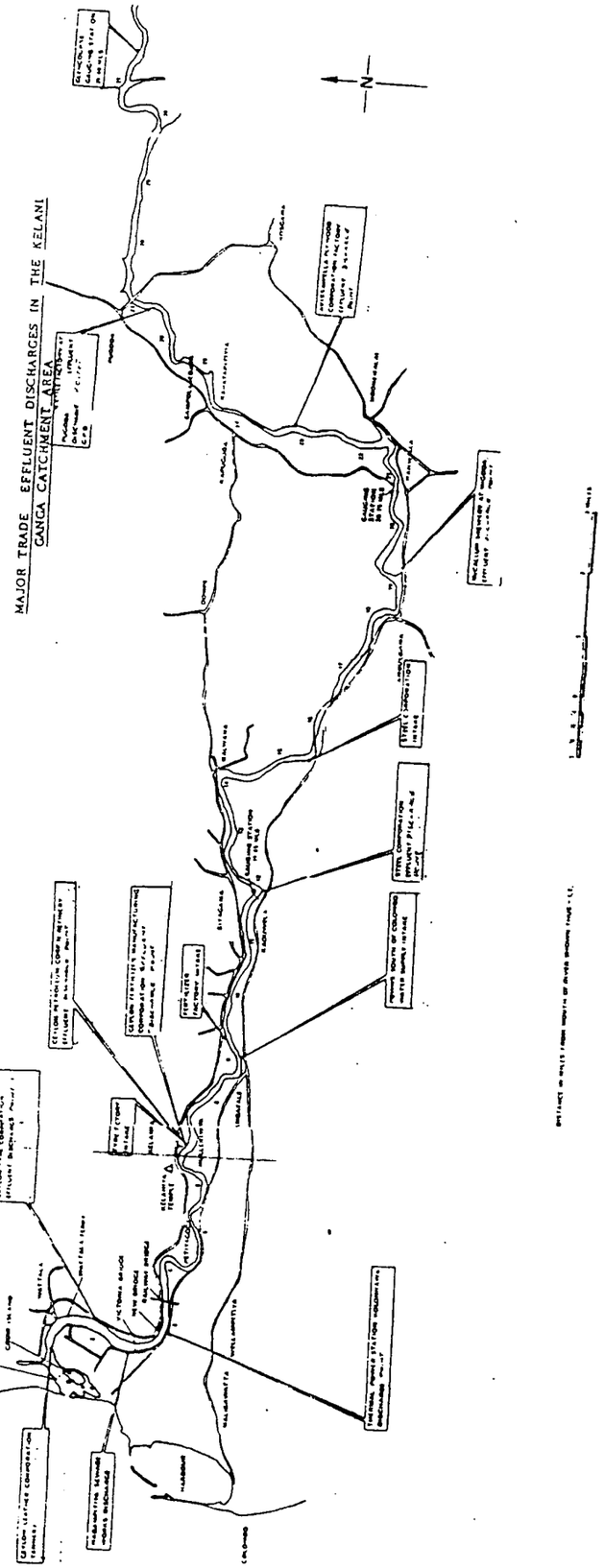
c. The CEA is looking into the possibility of collecting and publishing data obtained from previous studies and surveys.

2.4 Investigations have revealed that some of the effluents from industrial plants do not directly pollute Kelani River water. Waste water enters low-lying fields in the vicinity, leading to ground water contamination. These during rainy seasons could be washed into the river with rain water. The dual aspect of this type of pollution should be further considered.

2.5 CISIR investigations have revealed that industrial enterprises situated on the Colombo North Canal System constitute a major pollution load. It is recommended that studies on the Colombo North Canals be expanded in order to formulate an action plan for rehabilitation of the canal system.

2.6 The Central Environmental Authority in 1983, laid down interim standards for effluents being discharged into water-bodies, and it is recommended that legislation be enacted to provide their effective enforcement.

2.7 Continuous monitoring of ambient air quality should be combined particularly around the State Fertilizer Manufacturing Corporation, Tyre Corporation and Petroleum Refinery.



FINDINGS AND RECOMMENDATIONS BASED ON THE CISIR REPORTS

PART I

Leather Products Corporation Tannery, Mattakkuliya.

Both the CISIR and the Howard Humphreys Report of 1972 point out that there is high pollution from waste waters.

	CISIR figures (1983) mg/l	Std Limits mg/l
Chromium (Total)	417.5	1.0
Sulphides	2156	2.0
Organics		
COD	5900-380	300
Suspended Solids	2416	50
Total solids	28000-6500	

1. Removal of toxic chromium and sulphides from the effluent:

   It is considered that parameters for the chemical recovery of chromium for reuse from the factory wastes could be worked out. Government aid could be obtained to install and operate this treatment facility.

   The CEA, GCEC and UDA are currently working on the possibility of relocating medium and small scale tanneries in the Kelaniya area so that this treatment process could be made use of as a common treatment plant, on a cost sharing basis.
2. Removal of Tannins (phenolics)
3. Removal of fleshings and suspended solids by screening.

PART II

Madampitiya Sewage Works

Raw Sewage is discharged without treatment.

A problem encountered is that part of the city storm water discharges into sewers, while there are also industries illegally discharging wastes into sewers. The result is that grit, sand etc., from the former, plus wastes from the latter pass through Madampitiya without any treatment.

1. In view of the proposed northern ocean outfall, there should be at least screening and preliminary treatment at Madampitiya to remove solids.
2. The system should be rehabilitated so that partial treatment is possible, lowering Nitrogen and organics.
3. It may then be possible to treat the effluent to lower the load of pathogenic bacteria as a result of which enteric diseases are endemic in this part of the Kelani (Annex VI)

PART III

Ambatale Water Treatment Plant

A major source of pollution is the large quantity of settleable solids resulting from treatment, which could cause pollution of groundwater .

1. A feasibility study could be done for evolving low cost methods for the disposal of sludge.
2. COD and suspended solids of the effluent needs continuous monitoring, as, if the amount of suspended solids is high bottom fauna and flora of the river would be affected. Colloidal suspensions could affect aquatic life.

PART IV

Plywood Corporation Wood-work Complex, Kosgama

The main problem is considered to be the wood residues left lying around in the factory premises, which could on leaching be a threat to the groundwater quality in the area.

1. Effective methods of disposal of solid wastes should be implemented
2. Periodic monitoring for phenols
3. High COD values are obtained in the domestic effluent. A detailed evaluation of the treatment of domestic effluent should be made and the system improved.
4. Adequate monitoring of dust pollution is recommended.

PART V

Kalatuwawa Water Works

All parameters tested for, on the effluent, meet the specifications for effluent to be discharged into inland surface waters. (Ref. CEA Interim Standards).

The discharge of effluent into the river does not significantly affect the quality of the receiving water.

PART VI

Labugama Water Works

There is no wastewater originating from this plant , at present.

PART VII

Petroleum Refinery

Techniques used for oil separation from waste water was found to be efficient.

Periodic checks for phenolic compounds in the effluent is advisable.

Ambient air quality could be monitored (for SO_2) periodically.

PART VIII

State Fertilizer Manufacturing Corporation

The effluent basin contains very high quantities of Ammoniacal Nitrogen and free Ammonia.

1. The Central Environmental Authority has recommended that the effluent in the basin be monitored daily and diluted with raw water to bring down the Ammonia values to the required limits at all times so that, accidential pollution of the river can be kept under control.

   There is adequate provision in the plant for taking such measures.

2. Air Pollution - needs monitoring continuously. Comprises of NH_3, urea dust and SO_2. The latter can cause Acid rain.

   Installation of monitoring device for continuous monitoring of gases emanating from chimney, is advisable.

PART IX

McCallum Brewery

Effluents from the domestic sewage and factory wastes are discharged into paddy fields.

The effects of this on groundwater needs to be investigated as the effluent contains high values for BOD, COD and Total Coliforms.

The high Coliform count is a possible threat to groundwater.

Disinfection and Biological treatment are recommended.

PART X

Ocean Foods and Trades

1. Effluent is not discharged into the Kelani Ganga.
2. Factory does not operate regularly and as a result of its low capacity, total pollution load is expected to be comparatively low.

PART XI

Pugoda Textile Mills

1. Wastewaters containing textile dyes, Acids and Alkali are discharged into the Kelani without treatment.
2. Total pollution load is extremely high due to the large volume of effluent being discharged per day.
3. It is recommended that the proposed treatment plant be commissioned without delay. (as outlined in the CISIR report) to reduce this load to the standard values.

PART XII

Steel Corporation - Oruwela

1. Periodic checks should be made for ambient air quality.

2. No waste water from the Corporation enters the Kelani at the present time.
3. Neutralising of pickling waste water should be carried out as overflows from effluent storage lagoon pass into surrounding paddy fields and finally into the river.

PART XIII

British Ceylon Corporation Ltd.

Effluents from this factory pass into the San Sebastian Canal by way of several outlets. This finally enters the Kelani River.

All the parameters tested for in the effluent have failed to meet the Interim Standards outlined by the CEA.

Since all effluent pass into the Canal without treatment, the factory constitutes a major pollution load.

Installation of adequate treatment facilities to ensure the discharge of wastes meeting set norms should be made immediately.

PART XIV

Petroleum Storage Complex - Kolonnawa

1. Oils and grease and suspended solids fails to meet the specifications for tolerance limits for industrial waste water discharged into inland surface waters.
2. It is recommended that measures are taken to ensure proper disposal of barrels used to import pesticides. At present these barrels are perforated at the bottom and stacked in the yard.

PART XVII (B)

Ceylon Cold Stores - Bottling Plant, Kaduwela.

1. A total volume of 32,000 gal/d of effluent is discharged into a series of settling tanks where neutralisation is carried out.
2. Values for pH and total alkalinity are in excess of tolerance limits to be discharged into surface waters. Neutralisation, if regularised on a volumetric basis would reduce on these values.
3. Good housekeeping practises would prevent on the excessive discharge of oil and grease.
4. Dumping of solid wastes could lead to groundwater contamination and therefore should be handled appropriately.

PART XVIII (A)

Ceylon Tyre Corporation

1. Chlorination should be effectively carried out in the sewage treatment plant, to reduce on the total bacterial count.
2. Using solid waste from factory as landfill is recommended, instead of burning openly as this constitutes a significant source of air pollution.

B. Water Treatment Plant, Biyagama

Effluents are carried into a sludge pit from where it enters the river.
Values for settleable solids and aluminium in the effluent is high.
Adequate disposal of sludge is recommended .

3. Ensure proper disposal of sludge from leaded gasoline tanks owing to it's toxicity.

4. Careful removal of oil through oil traps.

PART XV

Lever Brothers (Ceylon) Ltd.

Wastes from the factory are disposed of into the San Sebastian Canal.

Values for BOD, total suspended solids, oils and grease and Phosphate of final effluent exceed limits specified by CEA.

Volume of effluent is very large 700,000 litre/hour (part of this is recycled).

There exists no waste treatment.

Adequate effluent treatment processes should be installed with immediate effect.

PART XVI

Kelanitissa Power Station

Waste water is disposed of by underground pipe and surface drainage to Kelani River. Presently, there is no thermal pollution.

Reported oil spillages could be avoided if proper housekeeping is observed and

Installation of oil traps are needed in the drainage system.

PART XIX

Lankem Ceylon Limited

1. Accidential spillages of pesticides are absorbed into saw dust (after neutralising with 5% NAOH) and burnt in the open scrap yard.

   Proper incineration is recommended as some pesticides are stable thermally.

2. Damaged empty pesticide barrels and cans left in the scrap yard are washed into the drains with rain. It is recommended that proper stacking of these are maintained until properly disposed of to prevent such occurrences.

3. Adequate safeguards should be provided to workers handling asbestos fibres.

4. It is noted that the canal water is used by slum dwellers living on either side of bank.

PART XX

Synthetic Textile Mills

1. Effluents are discharged into drains which fall into the Dematagoda Canal without treatment.

2. All parameters tested for, failed to meet the CEA Interim Standards for waste water to be discharged into inland surface waters.

3. Treatment of effluent is strongly recommended.

PART XXI

Ceylon Transport Board Depot - Peliyagoda

1. Values for oils and grease in the effluent are far in excess of standards. Installation of oil trap is recommended.

ANALYSIS OF INDUSTRIAL WASTES

INDUSTRIAL UNITS	VOLUME OF EFFLUENT m^3/d	T°C	COLOUR PTATINUM COBALT UNITS	TOTAL SOLIDS mg/l	SUSPENDED SOLIDS mg/l	SETTLEABLE SOLIDS mg/l	pH	CHLORIDE (AS Cl) mg/l	ALKALINITY mg/l	TOTAL NITROGEN mg/l	AMMONIACAL NITROGEN	PHOSPHATES (PO_4^{--})	CONDUCTIVITY mmho/cm	SULPHIDES mg/l	PHENOLIC COMPOUNDS mg/l	OIL + GREASE mg/l	COD mg/l	CHROMIUM (AS Cr)	DO mg/l	BOD mg/l	TOTAL COLIFORM COUNT / ml
01 LEATHER PRODUCTS CORPORATION TANNERY	55	--	--	L 6,500° U28,000	3416°	--	L 2.7° U 11.3	--	--	L 53° U 778	--	--	--	2916°	--	--	L 360° U5,700°	417.3°	--	--	--
02 NADAMPITIYA SEWAGE WORKS	90,000	L 25.0 U 35.0	--	--	--	--	8.3	--	--	L .16 U 43	--	--	--	--	--	--	L 247 U 514°	--	--	--	L 9,500° U 349,800°
03 AMBATALE WATER TREATMENT PLANT	12,685	--	--	15,300°	14,300°	14,100	6.0	--	--	--	--	--	--	--	--	--	1,750°	--	--	--	--
04 PLYWOOD CORPORATION WOOD WORK COMPLEX	2,000	L 27 U 31	--	--	L 11.3° U 52.6	--	L 4.6 U 6.8	--	--	3.8	--	--	--	--	--	--	L 50 U1,340°	--	--	--	750
05 KALATUWAWA WATER WORKS	16,810	--	--	75	19.5	9.5	7.5	--	--	--	--	--	--	--	--	--	47	--	5.7	--	9
06 LABUGAMA WATER WORKS	HOME AT PRESENT																				
07 C.P.C. PETROLEUM REFINERY	--	31	--	965	10	--	9.85°	185	136	11.2	9.1	--	1,080	2.61°	6.5°	5.5	607°	--	--	--	--
08 STATE FERTILIZER MANUFACTURING CORP.	--	34.6	--	--	2.5	--	9.9°	--	--	237	729°	1.08	1,650	--	--	5.4	170	--	4.45	--	--
09 McCALLUM BREWERY	21	28	--	544	34	--	5.5	--	--	16	--	--	--	--	--		1,132°	--	--	930°	1,122,800°
10 OCEAN FOODS AND TRACES (CAJ) LTD.																					
11 PAGODA TEXTILES LIMITED	2,270	36.5	341°	2,931°	82°		8.6	100.5		L 19.3 U 27.0				0.04		4.1	L 461° U 703	NOT DETECTED			
12 STEEL CORPORATION ORUWELA																					
13 B.C.C. LIMITED	11/batch	L 41° U 44	--	--	L 387° U 2180°	--	L 10.3 U 13.4	39,300°	one : L 24.9 U36,900 two:L 334 or:U83000	--	--	--	--	--	--	NIL	L 2280° U 105	--	--	--	--
18 PETROLEUM STORAGE COMPLEX, KOLONNAWA	--	28			L . 3° U 58°		L 6.1 U 6.7									L 0.4 U 81°	L 31 U 137		L 3.2° U 5.8°	40°	
15 LEVER BROTHERS (CEYLON) LIMITED	16,800	--	--	--	L 9° U 95°	--	L 6.58 U 7.21	--	0.072	--	L 2.2 U 3.4	L 0.84 U 3.0	--	--	--	11.5°	L 63 U 243	--	--	L 80 U 162°	--
16 KELANI TISSA POWER STATION																					
17 CEYLON COLD STORES BOTTLING PLANT - KADUWELA	144	32.8	--	--	--	--	11.4°	--	L 66.2° U 71.5	--	--	--	--	--	--	15°	129	--	--	--	--
18 (a)CEYLON TYRE CORPORATION	--	30.0	--	--	19	--	6.57	--	--	--	--	--	--	--	--	4.1	1.84	--	--	2	1,160°
(b)WATER TREATMENT PLANT-OF THE TYRE CORP-BIYAGAMA	2,229	--	--	187	15	167	6.6	--	--	--	--	--	--	--	--	--	50	--	--	--	--
19 LANKEM (CEYLON) LIMITED		28.5	--	L 300 U 864	L 50° U 74°	--	L 6.33 U 7.28	--	--	3.92	--	1.9°	--	--	--	--	L 148° U 360°	--	--	--	--
20 SYNTHETIC TEXTILES LIMITED			400°	--	1	--	7.1	--	--	288°	48.3	1.6	--	--	--	.28°	530°	--	--	--	--
21 CTB DEPOT - PELIYAGODA	--	--	--	--	--	--	6.5	--	--	--	--	--	--	--	--	452°	144	--	--	--	--
SEA INTERIM STANDARDS FOR WASTE WATER TO BE DISCHARGED INTO INLAND SURFACE WATERS	--	40	--	--	50	--	5.5 - 8.5	1.0	--	--	50	--	--	2.0	1.0	10	250	0.1	--	30	--

-- NOT ANALYSED

° EXCEED TOLERANCE LIMITS FOR WASTE WATER TO BE DISCHARGED INTO INLAND SURFACE WATERS

L LOWER LIMIT

U UPPER LIMIT

INDUSTRIAL UNIT	PRODUCTS AND/OR PROCESSES	EFFLUENTS	DIRECT/INDIRECT DISCHARGE INTO KELANI GANGA	DISTANCE FROM RIVER MOUTH KM.	DISTANCE OF DISCHARGE FROM FACTORY KM.	MAIN PROBLEMS	OTHER COMMENTS AND RECOMMENDATIONS
01 LEATHER PRODUCTS CORPORATION TANNING FACTORY	(i) CHROME TANNING (ii) VEGETABLE TANNING	COMBINED TANNERY EFFLUENT AND SOLID WASTES	DIRECT	1.2		CHROME TANNING AND VEGETABLE TANNING EFFLUENTS FAIL TO MEET STANDARDS IN RESPECT OF ALL PARAMETERS TESTED CHROMIUM WAS DETECTED IN RIVER MUD. STRONG ODOUR FROM SOLID WASTE DUMPING.	THE RIVER IS SUBJECT TO MANY FORMS OF POLLUTION FROM THIS FACTORY. WASTE TREATMENT IS AN URGENT NECESSITY.
02 KADUWELA SEWAGE WORKS	SEWAGE TREATMENT	RAW UNTREATED SEWAGE	DIRECT	4.0		VERY HIGH COLIFORM COUNT (per ml SEWAGE)	IT IS NOTED THAT EFFLUENT BEING DISCHARGED IN A DILUTED FORM AS STORM WATER PASSES THROUGH THIS DISCHARGE POINT.
03 AMBATALE WATER TREATMENT PLANT	WATER TREATMENT	SLUDGE, BACK WASH WATER FROM SAND FILTER	INDIRECT - INTO AMBATALE ELA ALSO ENTERS FIELDS	14		MAIN OFFENDING PARAMTERS ARE TOTAL AND SUSPENDED SOLIDS AND COD. SLUDGE - CONTAINING SETTLEABLE SOLIDS Al(OH)$_3$ DEPOSITS IN FIELDS.	IN DRY SEASON WASTE WATER STAGNATION IN FIELD COULD LEAD TO GROUNDWATER POLLUTION SETTLEABLE SOLIDS DEPOSITING IN THE RIVER MUD CAN AFFECT BOTTOM FAUNA AND FLORA.
04 PLYWOOD CORPORATION WOOD-WORK COMPLEX, KOSGAMA	CHIPBOARD, - FURNITURE - PLYWOOD	DOMESTIC AND FACTORY EFFLUENT	DIRECT - VIA UNDERGROUND PIPE LINE. INDIRECT - VIA KALANGODA ELA, KOSGAMOYA	40	3	MAIN OFFENDING PARAMETER IS COD. SOLID WASTE WOULD BE A THREAT TO GROUND WATER.	AN EVALUATION OF THE TREATMENT PLANT FOR DOMESTIC EFFLUENT SHOULD BE CARRIED OUT. EFFECTIVE METHOD FOR SOLID WASTE DISPOSAL SHOULD BE IMPLEMENTED.
05 KALATUMANA WATER WORKS	WATER TREATMENT	SLUDGE, BACKWASH WATER FROM SAND FILTERS	INDIRECT - VIA KALATUMENA ELA, MAK OYA INTO KELANI GANGA	40	14	ALL PARAMETERS TESTED FELL WITHIN CEA STANDARDS. NO POLLUTION PROBLEMS AT PRESENT.	A FURTHER STUDY OF THE WASTE WATER SHOULD BE UNDERTAKEN WHEN CHEMICAL FLOCCULATION IS EMPLOYED IN WATER TREATMENT.
06 LABUGAMA WATER WORKS	WATER TREATMENT	NONE	---	39		NO POLLUTION AT PRESENT.	SAND FILTER BACKWASH WOULD RESULT IN AN EFFLUENT, BUT DUE TO THE HIGH PURITY OF RAW WATER NOT CONSIDERED A THREAT.
07 PETROLEUM REFINERY	CRUDE DISTILLATION, NAPHTHA HYDRATING-KEROSENE SWEETING, VIS BREAKING, LPG TREATMENT	COMBINED REFINERY WASTES	DIRECT - VIA UNDERGROUND PIPE TO RIVER	12	3	VALUES FOR pH, PHENOLIC COMPOUNDS, SULPHIDES AND COD FAIL TO MEET SPECIFICATIONS.	PERIODIC CHECKS ON PHENOLIC COMPOUNDS IS ADVISABLE.
08 STATE FERTILIZER MANUFACTURING CORPORATION	UREA	DOMESTIC AND FACTORY EFFLUENT	DIRECT - VIA UNDERGROUND PIPELINE	12	3	FREE AMMONIA CONTENT EXTREMELY HIGH.	EFFLUENT BASIN BE MONITORED DAILY AND DILUTED TO BRING DOWN AMMONIA VALUES. SLUDGE FROM WATER TREATMENT PLANT BE SEPARATED IN A SLUDGE DRYING BED.
09 McCALLUM BREWERY	BEER	BREWERY EFFLUENT AND DOMESTIC WASTES	INDIRECTLY VIA PADDY FIELDS AND OPEN CHANNELS	30	07	HIGH BOD AND COD. HIGH COLIFORM COUNT	EFFLUENT TREATMENT SHOULD BE CARRIED OUT BEFORE DISCHARGE. BIOLOGICAL TREATMENT OF EFFLUENT BE EFFECTED.
10 OCEAN FOODS AND TRADES (CEL) LIMITED	PRAWNS FOR EXPORT PURPOSES	SOLID WASTES, WASTE WATER	NONE INTO THE KELANI RIVER	02		WASTE WATERS PASS INTO UNLINED PITS. THREAT TO GROUNDWATER.	FACTORY DOES NOT OPERATE REGULARLY AND DUE TO ITS LOW CAPACITY, TOTAL POLLUTION LOAD IS EXPECTED TO BE COMPARATIVELY LOW.
11 PUGODA TEXTILE MILLS	COTTON/RAYON FABRIC	WASTES FROM MILL, TREATED DOMESTIC EFFLUENT	DIRECT - VIA STREAM	44	1.9	VALUES FOR COD AND SUSPENDED SOLIDS, COLOUR EXCEED PERMISSIBLE LIMITS.	THE PROPOSED TREATMENT PLANT SHOULD BE COMMISSIONED WITHOUT DELAY AS THE TOTAL POLLUTION LOAD FROM THE MILL IS EXTREMELY HIGH.
12 STEEL CORPORATION - ORUWELA	STEEL	PICKLING LIQOUR, LIME SOLUTION	WASTE WATER DOES NOT ENTER THE KELANI RIVER	18	4.3		PICKLING WASTE WATER IS DISCHARGED INTO A STORAGE LAGOON WHICH OVERFLOWS INTO PADDY FIELDS. SLUDGE FROM SEDIMENTATION TANKS ARE DUMPED IN PREMISES.
13 BRITISH CEYLON CORPORATION LIMITED	TOILET PRODUCTS, LAUNDRY SOAPS, DISINFECTANTS, COOKING OIL	EFFLUENT FROM OIL, SOAP REFINERY, DISINFECTANT PLANT DOMESTIC	INDIRECT - VIA SAN SEBASTIAN CANAL	SITUATED ALONG SAN SEBASTIAN CANAL		ALL TESTED PARAMETERS FAILED TO MEET CEA INTERIM STANDARDS HIGH COD, ALKALINITY	COMPREHENSIVE STUDY RECOMMENDED TO ASCERTAIN VOLUMES OF EFFLUENT, THEIR IMPORTANCE AND PATHS OF DISCHARGE. A STUDY OF CANAL WATER AT DIFFERENT TIMES OF THE YEARS APPEARS IMPORTANT.
14 PETROLEUM STORAGE COMPLEX, KOLONNAWA	LUBRICATING OIL, CANDLES, REPACKING AGRO-CHEMICALS	WASTE WATER FROM DOMESTIC SOURCES, LABORATORY, TANK YARDS	INDIRECT - VIA DEMATAGODA CANAL	SITUATED ALONG DEMATAGODA CANAL		COD, OILS AND GREASE, SUSPENDED SOLIDS FAIL TO MEET SPECIFICATIONS.	DISPOSAL OF PESTICIDE CONTAINERS, DISPOSAL TOXIC SLUDGE FROM LEADED PETROL, PESTICIDE SPILLAGE AND CAREFUL REMOVAL OF OIL SHOULD BE GIVEN SPECIAL ATTENTION.
15 LEVER BROTHERS (CEYLON) LTD	SOAPS, EDIBLE FATS, HOUSEHOLD TOILETRIES, YEAST	WASTE WATER FROM REFINERY, FINISHING PLANTS	INDIRECT - VIA SAN SEBASTIAN CANAL	SITUATED ALONG SAN SEBASTIAN CANAL		VALUES FOR BOD, TOTAL SUSPENDED SOLIDS, OIL AND GREASE, PHOSPHATE EXCEED LIMITS.	TOTAL POLLUTION LOAD VERY HIGH. IMPLEMENTATION OF TREATMENT PLANT IMMEDIATE NECESSITY.
16 KELANI TISSA POWER STATION	GENERATION OF ELECTRICITY	COOLING WATER, STORM WATER	DIRECT - VIA UNDERGROUND PIPELINE. INDIRECT - VIA KITTAMPAHUWA CANAL	04		OIL SPILLAGE.	OIL SPILLAGES COULD BE AVOIDED IF GOOD HOUSEKEEPING PRACTICES OBSERVED. OIL TRAPS NEAR OUTLETS OF THE OPEN DRAINAGE SYSTEM SHOULD BE INSTALLED.

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INDUSTRIAL UNIT	PRODUCTS AND/OR PROCESSES	EFFLUENTS	DIRECT/INDIRECT DISCHARGE INTO KELANI GANGA	DISTANCE FROM RIVER MOUTH KM.	DISTANCE OF DISCHARGE FROM FACTORY KM.	MAIN PROBLEMS	OTHER COMMENTS AND RECOMMENDATIONS
17 CEYLON COLD STORES BOTTLING PLANT - KADUWELA	SOFT DRINKS	WASTE WATER, BACK WASH FROM SAND FILTERS, SOLID WASTE, DOMESTIC	DIRECT - VIA UNDERGROUND PIPELINE	11		pH ALKALINITY, OIL AND GREASE VALUES VERY HIGH.	DEGRADATION OF SOIL, DUE TO DUMPING OF SOLID WASTE WOULD BE A THREAT TO GROUND WATER. NEUTRALISING OF EFFLUENT RECOMMENDED TO REDUCE ON VALUES FOR TOTAL ALKALINITY. GOOD HOUSEKEEPING PRACTISES SHOULD BE MAINTAINED.
18 (A) CEYLON TYRE CORPORATION	TYRE MANUFACTURE	FACTORY WASTE WATER	INDIRECT - VIA IRRIGATION CHANNEL	09	1.3	MOST OF THE PARAMETERS FALL WITHIN STANDARDS. LOW VALUES FOR BOD AND HIGH BACTERIAL COUNT. AIR POLLUTION.	USING SOLID WASTE FROM FACTORY AS LAND-FILL IS RECOMMENDED, AS BURNING IN THE OPEN CONSTITUTES AIR POLLUTION HAZARD.
(B) WATER TREATMENT PLANT OF THE TYRE CORPORATION, BIYAGAMA	WATER TREATMENT	SLUDGE, DOMESTIC WASTES	INDIRECT - VIA SLUDGE PIT	11		COD LOW, SETTLEABLE SOLIDS AND Al CONTENT OF SLUDGE VERY HIGH.	AS WASTES DO NOT DIRECTLY ENTER THE RIVER, POLLUTION PROBLEMS NOT CRITICAL.
19 LANKEM (CEYLON) LIMITED	AGROCHEMICALS, DETERGENTS, PAINTS, MOSQUITO COILS, THINNER	LABORATORY WASTES, ACCIDENTAL SPILLAGES, WASHINGS	INDIRECT - VIA DEMATAGODA CANAL	SITUATED ALONG DEMATAGODA CANAL		BURNING OF SAW DUST CARRIED OUT IN THE OPEN. COD, TOTAL SOLIDS, PHOSPHATES, OF EFFLUENTS HIGH.	PROPER INCINERATION OF SPILLAGES OF PESTICIDES RECOMMENDED, DUE TO PERSISTENCE IN THE ENVIRONMENT. PROPER STACKING AND DISPOSAL OF EMPTY CONTAINERS RECOMMENDED.
20 SYNTHETIC TEXTILES LIMITED	NYLONS, 100% POLYESTER, POLYESTER COTTON	DYE WITH WASTE WATER	INDIRECT - VIA DEMATAGODA CANAL	SITUATED ALONG DEMATAGODA CANAL		COD, TOTAL SOLIDS, COLOUR, TOTAL NITROGEN IN EFFLUENT HIGH.	TREATMENT OF EFFLUENT RECOMMENDED AS POLLUTION LOAD IS HIGH.
21 CEYLON TRANSPORT BOARD, DEPOT - PELIYAGODA	SERVICING OF BUSES, WASHING OF BUSES	DOMESTIC BUS WASHINGS, SERVICE WASHINGS	DIRECT - VIA DRAINS	9.5		OIL AND GREASE VERY HIGH.	INSTALLATION OF OIL TRAPS AN IMMEDIATE NECESSITY.